

MMS ENVIRONMENTAL STUDIES PROGRAM: ONGOING STUDIES

Region: Alaska

Planning Areas: Beaufort Sea, Chukchi Sea, Cook Inlet, North Aleutian Basin

Title: Empirical Weathering Properties of Oil in Snow and Ice (AK-04-06)

MMS Information Needs to be Addressed: The Alaska Region of the MMS leases in areas which are ice covered. Better estimates of the weathering of oil in snow and ice are important to further impact assessment and oil spill contingency and response planning. Study results will be used for NEPA analysis and documentation for Beaufort Sea Lease Sales, Cook Inlet Lease Sales, Chukchi Sea Sales, the North Aleutian Basin Lease Sale, DPPs, and associated Oil Discharge Prevention and Contingency Plans.

Total Cost: \$632,000

Period of Performance: FY 2004-2008

Conducting Organization: MAR, Inc.

MMS Contact: [Chief, Alaska Environmental Studies Section](#)

Description:

Background Oil spill weathering models are used in National Environmental Policy Act (NEPA) analysis as well as Oil Discharge Prevention and Contingency Plans (ODPCPs). The results of these models are used to estimate impacts in NEPA analysis as well as pre-planning for oil spill response. A modest amount of work in the field was done in the 1970's and 1980's on first order physics for oil weathering in ice. Additional studies have continued in the laboratory in the late 1980's and 1990's, but were generally limited to low viscosity, low pour-point oils. We now know that oil weathering is strongly dependent on the specific chemical composition and characteristics of individual crudes. The physical and chemical data required by modern state-of-the-art models (such as the SINTEF oil weathering model used by MMS in Alaska) are scarce, of poor quality, or nonexistent for oil-ice interaction. Such models, therefore, ignore the more difficult aspects of oil-in-ice weathering. Sophisticated measurement techniques currently available would enable precise measurements regarding oil evaporation, spreading, and dispersion in ice (as well as on ice) as a function of oil type and chemistry.

Objectives

1. For low and high pour-point oils, measure emulsification, evaporation, dispersion, spreading, slick thickness, and oil composition in an ice field and snow on top of sea ice.
2. Develop a database on oil weathering in ice fields for use in model validation.
3. Use these data, in concert with other oil-ice weathering data, to validate and enhance or develop new algorithms of oil weathering in ice.

Methods Collect and analyze data on weathering of oil in ice and snow on top of sea ice, including but not limited to evaporation, emulsion, dispersion, spreading and slick thickness. Dependant tasks include developing a dataset from the experimental data for use to validate weathering algorithms and oil weathering models in the presence of ice. Create a database or

experimental data set of oil weathering parameters in ice fields and snow. Some of this work should be done with both high and low pour point oils. Liberty crude would be an example of a high-pour crude with pour point above environmental temperatures. Validate or enhance oil in ice weathering algorithms. Include recommendations for new algorithms in the oil weathering model that are validated by the field results.

Current Status:

Scheduled outdoor snow and ice weathering experiments in Ottawa, which had been deferred in winter 2005-2006 because record warm Ottawa temperatures, were completed in winter 2006-2007.

Final Report Due: June 2008

Publications Completed:

Buist, I.; Belore, R.; Hackenberg, D.; Devitis, D.; Dickins, D.; Hollebone, B.; Wang, Z.; and R. T. Prentki. 2005. Empirical Weathering Properties of Oil in Snow and Ice. In: OCS Study MMS 2005-036 "Alaska OCS Region Tenth Information Transfer Meeting and Barrow Information Update Meeting, Final Proceedings, pp. 46-47, prepared by MBC Applied Environmental Sciences, Costa Mesa, CA for MMS Alaska OCS Region, Anchorage, AK.

Brandvik, P. J., P. S. Daling, D. Dickins, and I. Buist. 2007. Behavior and Weathering of Oil Spills Under Arctic Conditions and Implications for Response. In: International Oil and Ice Workshop 2007. Ottawa, ON

Affiliated WWW Sites: <http://www.marinc.com/>
<http://www.ohmsett.com/>
<http://www.slross.com/>
<http://www.mms.gov/alaska/>

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